REMARKS

In the Office Action, claims 1, 2, 7-14 and 18-22 were rejected. Claims 3-6 and 15-17 were objected to. Claims 1, 8, 14, 18, 19, 20, 21 and 22 have been amended. Upon entry of the amendments, claims 1-22 will be pending in the present patent application. Reconsideration and allowance of all pending claims are requested.

Claim Objections

Claim 8 was objected to because of informalities. Claim 8 was amended to remove the informality noted by the Examiner. Accordingly, Applicant respectfully requests that the objection to claim 8 be withdrawn.

Rejections under 35 U.S.C 102

Claims 1, 2, 13, 14 and 18-22 were rejected under 35 U.S.C 102(b) as being anticipated by "Iterative Reconstruction for Reduction of Metal Artifacts in Computed Tomography" (hereinafter, "De Man"). Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration.

Claims 1, 14, 18, 19, 20, 21 and 22 have been amended to more clearly recite the invention. No new matter has been added.

Claims 1, 14, 18, 19, 20, 21 and 22 and claims depending therefrom

Claim 1 is directed to a method for reducing artifacts in image data generated by a computed tomography system, the artifacts being due to the presence of a high density object in a subject of interest. The method comprises receiving measured sinogram data from the computed tomography system. The sinogram data is representative of a plurality of measured sinogram elements. The method further comprises reconstructing the measured sinogram data to generate initial reconstructed image data, identifying a trace of the high density object in the measured sinogram data, identifying a region of interest in the initial reconstructed image data, identifying an optimization criterion based upon the region

of interest, in an image domain, iteratively adjusting the measured sinogram elements at least in the trace of the high density object in the measured sinogram data based upon the optimization criterion in the image domain to generate corrected sinogram data, and reconstructing the corrected sinogram data to generate improved reconstructed image data. Claims 18 and 21 recite similar subject matter in the context of a computed tomography system. Likewise, claim 19 recites similar subject matter in the context of a computer-readable medium.

Claim 14 is directed to a method for reducing artifacts in image data generated by a computed tomography system, the artifacts being due to the presence of a high density object in a subject of interest. The method comprises receiving measured sinogram data from the computed tomography system. The sinogram data is representative of a plurality of measured sinogram elements. The method further comprises reconstructing the measured sinogram data to generate initial reconstructed image data, identifying a trace of the high density object in the measured sinogram data, iteratively adjusting the measured sinogram elements at least in the trace of the high density object in the measured sinogram data to generate corrected sinogram data, and reconstructing the corrected sinogram data to generate improved reconstructed image data. Claim 20 recites similar subject matter in the context of a computer-readable medium.

Claim 22 is directed to a method for reducing artifacts in image data generated by a computed tomography system, the artifacts being due to the presence of objects in a subject of interest. The method comprises receiving measured sinogram data from the computed tomography system. The sinogram data is representative of a plurality of measured sinogram elements. The method further comprises reconstructing the measured sinogram data to generate initial reconstructed image data, identifying a sinogram region of interest in the measured sinogram data, identifying an image region of interest in the initial reconstructed image data, identifying an optimization criterion based upon the image region of interest in an image domain, iteratively adjusting the measured sinogram elements in at

least the sinogram region of interest based upon the optimization criterion in the image domain to generate corrected sinogram data, and reconstructing the corrected sinogram data to generate improved reconstructed image data.

De Man does not disclose adjusting or otherwise altering the *measured data*.

De Man is a thesis directed to the study of metal artifacts in computed tomography images. In particular, De Man is directed to the reduction of metal artifacts in CT images using iterative reconstruction techniques.

Applicant respectfully submits that De Man does not disclose a method for reducing artifacts in image data generated by a computed tomography system, comprising at least the step of iteratively adjusting the *measured sinogram elements* at least in the trace of the high density object in the measured sinogram data to generate corrected sinogram data, as recited in independent claims 14 and 20. Further, De Man does not disclose a method for reducing artifacts in image data generated by a computed tomography system, comprising at least the step of iteratively adjusting the *measured sinogram elements* at least in the trace of the high density object in the measured sinogram data based upon the optimization criterion in the image domain, to generate corrected sinogram data as recited in claims 1, 18, 19 and 21. In addition, De Man does not disclose a method for reducing artifacts in image data generated by a computed tomography system, comprising at least the step of iteratively adjusting the *measured sinogram elements* in at least the sinogram region of interest based upon the optimization criterion in the image domain to generate corrected sinogram data, as recited in claim 22.

Applicant has carefully reviewed section Fig. 4.1, pages 66-76, page 98 cited by the Examiner in De Man, and submits that this section does not disclose the step of iteratively adjusting the *measured sinogram elements* in the trace of the high density object in the measured sinogram data to generate corrected sinogram data. Furthermore, this section does not disclose the step of iteratively adjusting the measured sinogram elements in the

trace of the high density object in the measured sinogram data based upon the optimization criterion in the image domain to generate corrected sinogram data.

Instead, this section merely discloses the steps performed by a standard iterative reconstruction technique. In particular, this section discloses that a typical iterative reconstruction technique starts with an initial image and calculates a corresponding sinogram. The *calculated sinogram* is then compared to the *measured sinogram* and the sinogram error is transformed back to the image domain and subtracted from the current reconstruction. This process is repeated a number of times, until a good reconstruction is obtained. Of note is that the measured sonogram elements are never adjusted, particularly because they are used as a basis for comparison or reference as the calculated sonogram is iteratively recomputed.

Clearly, the above section only indicates that each iteration in a standard reconstruction technique results in a solution wherein the calculated sinogram matches the measured sinogram with greater accuracy. In other words, the calculated sinogram is compared to the measured sinogram for a specified number of iterations, until a desired solution (good reconstruction) is obtained. Specifically, the comparison is performed without altering the values of the measured sinogram elements, *i.e.*, by keeping the values of the measured sinogram elements constant, at each iteration. Furthermore, while other reconstruction techniques, such as projection completion, are known in the art to perform adjustments to measured sinogram elements, these techniques are not capable of iteratively adjusting measured sinogram elements present in a trace of a high density object in measured sinogram data, *based upon an optimization criterion in the image domain.*

In contrast, in the claimed technique, the measured sinogram elements themselves are altered, *i.e.*, iteratively adjusted to generate corrected sinogram data. Specifically, and as recited in amended claims 14 and 20 the measured sinogram elements are iteratively adjusted at least in the trace of the high density object in the measured sinogram data, to

generate corrected sinogram data. Furthermore, and as recited in amended claims 1, 18, 19, 21 and 22, the measured sinogram elements are iteratively adjusted at least in the trace of the high density object in the measured sinogram data, based upon an optimization criterion in the image domain, to generate corrected sinogram data.

Because De Man fails to teach or suggest at least that (1) the measured sinogram elements are iteratively adjusted at least in the trace of the high density object in the measured sinogram data, to generate corrected sinogram data, and (2) the measured sinogram elements are iteratively adjusted at least in the trace of the high density object in the measured sinogram data, based upon an optimization criterion in the image domain to generate corrected sinogram data, De Man cannot anticipate claims 1, 14, 18, 19, 20, 21 and 22. Accordingly, claims 1, 14, 18, 19, 20, 21 and 22 and claims depending therefrom are believed to be clearly patentable over De Man, as well as any other prior art of record. Thus, it is respectfully requested that the rejection of claims 1, 2, 13, 14 and 18-22 under 35 U.S.C. 102(b) be withdrawn.

Rejections under 35 U.S.C 103

Claim 7 was rejected under 35 U.S.C 103(a) as being unpatentable over De Man in view of U.S. Patent No. 6,385,278 (hereinafter, "Hsieh"). Claim 8 was rejected under 35 U.S.C 103(a) as being unpatentable over De Man in view of U.S. Patent Application Publication No. 2004/0001569 (hereinafter, "Luo"). Claim 9 was rejected under 35 U.S.C 103(a) as being unpatentable over De Man in view of U.S. Patent No. 6,813,374 (hereinafter, "Karimi"). For a *prima facie* case of obviousness, the Examiner must set forth the differences in the claim over the applied reference, set forth the proposed modifications of the reference, which would be necessary to arrive at the claimed subject matter, and explain why the proposed modification or combination would be obvious.

As summarized above, all of the independent claims are believed to be patentable over De Man. The Hsieh, Luo and Karimi references have been reviewed with respect to

the 35 U.S.C 103(a) rejections and do not supply the deficiencies of De Man in regards to disclosing at least the steps of (1) iteratively adjusting the measured sinogram elements at least in the trace of the high density object in the measured sinogram data, to generate corrected sinogram data and (2) iteratively adjusting the measured sinogram elements at least in the trace of the high density object in the measured sinogram data based upon the optimization criterion in the image domain to generate corrected sinogram data. Accordingly, claims 7, 8 and 9 are allowable by virtue of their dependency from allowable base claim 1, as well as for the subject matter they separately recite. Thus, it is respectfully requested that the rejection of claims 7, 8 and 9 under 35 U.S.C 103(a) be withdrawn.

Conclusion

In view of the remarks and amendments set forth above, Applicant respectfully requests allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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